

MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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No. 1

INTRODUCTION.

The MONTHLY WEATHER REVIEW for January, 1898, is based on 2,916 reports from stations occupied by regular and voluntary observers, classified as follows: 147 from Weather Bureau stations; numerous special river stations; 32 from post surgeons, received through the Surgeon General, United States Army; 2,567 from voluntary observers; 96 received through the Southern Pacific Railway Company; 23 from Life-Saving stations, received through the Superintendent United States Life-Saving Service; 31 from Canadian stations; 20 from Mexican stations; 7 from Jamaica, W. I. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Government Survey, Honolulu; Dr. Mariano Bárcena, Director of the Central Meteorological Observatory of Mexico; Mr. Maxwell Hall, Government Meteorologist,

Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; and Commander J. E. Craig, Hydrographer, United States Navy.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to generally conform to the modern international system of standard meridians, one hour apart, beginning with Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are generally corrected to agree with the eastern standard; otherwise, the local meridian is mentioned.

STORM WARNINGS AND WEATHER FORECASTS.

By Lieut. Col. H. H. C. Dunwoody, Supervising Forecast Official.

Under this head it is proposed to make note of all extreme and injurious weather conditions occurring during the month, and the warnings of the same issued by the Bureau, with instances, as far as reported by observers or the press, in which these warnings were of special public benefit. The signals displayed by the Weather Bureau will be referred to as "information," "storm," "hurricane," "cold wave," and "norther," respectively.

The injurious weather conditions of most marked note that occurred during the month, were the frosts and freezing weather in Florida on the 2d, 3d, and 4th, and in the citrus regions of southern California from the 10th to 13th and 20th to 27th, inclusive, the storms of the 21st to 23d and 24th to 26th, that moved from Texas northeast to the New England Coast, and the severe storm of January 31 to February 1, on the New England Coast. In this connection mention is also made of the moderate flood that occurred in the Ohio and central Mississippi valleys during the latter part of January and the early part of February.

THE FLORIDA FREEZE OF JANUARY 2-4, 1898.

Severe cold weather prevailed in Florida on the 2d, 3d, and 4th, freezing temperature on the 2d and 3d, and heavy frosts on the 4th, extending as far south as the latitude of Jupiter. Following are the minimum temperatures which were reported

from Jacksonville, Tampa, and Jupiter, respectively, viz January 2, 24°, 28°, 30°; January 3, 26°, 26°, 30°; January 4, 38°, 38°, 34°.

These conditions were very destructive to early vegetables throughout this region, killing nearly all those of the more tender kinds, except such as were protected. Considerable injury was done to citrus trees, many of the young trees and later shoots being destroyed. The pineapple interests also suffered some damage, although few, if any, plants were entirely killed.

Warnings of these injurious conditions were sent from the Central Office as follows: On the morning of January 1 telegrams to Jacksonville, Tampa, and Jupiter, reading: "For eastern Florida colder with freezing temperature in northern portions and frosts in southern portions Sunday morning." On the morning of January 2, telegrams to the same stations reading: "Freezing temperature and frosts in central and north portions, and severe frosts in south portion of Florida, Monday morning." Although both of the days on which these messages were sent were holidays, making effective dissemination difficult, the warnings were, through the efforts of the Weather Bureau observers, by means of the mail, telegraph, and telephone services, and the cooperation of the railroad officials, very widely distributed throughout the threatened districts, and enabled the people to take effective measures for the protection of their crops.

In this connection the following extracts from the reports of the Weather Bureau observers and newspaper publications are given:

From J. W. Cronk, Observer at Jupiter, January 11, 1898:

Never has a warning been more timely. The weather had been mild all along in this section, no sign of a frost, and vegetables and pineapples were simply luxuriant in their growth. Without the Weather Bureau's warning on January 1 planters would have been taken wholly by surprise. Planters began at once to protect their property.

From J. E. Lanouette, Observer at Tampa, Fla., January 11, 1898:

All local interests here promptly heeded the warning. To cite one instance, when the messenger reached the Tampa Bay Hotel with copies of the message, he found the head florist with a force of men busy at work covering up the tropical plants and flowers. He had already seen the cold-wave signal, and lost no time in taking the necessary precautions.

From letters received by A. J. Mitchell, Section Director, Jacksonville, Fla.:

The information from your office resulted in my saving more than \$500, and 25,000 to 30,000 plants. I gathered about 100 baskets of lettuce, which were sold at about \$2.25 per basket.

Advantage was taken of the warning by truckers and fruit growers to the extent that no serious damage was done by the cold on the 1st and 2d. The citrus trees are comparatively unhurt. Young trees were either banked or wrapped.

The warning was received in ample time, and in many instances around this section truck and oranges were saved. It is difficult to say, in so many dollars and cents, what the saving amounted to, but it is a fact that where people were provident and diligent enough to act on the warning, they were enabled to house fruit and protect vegetables. Potatoes and young orange wood were saved by being covered with dirt.

Everything saved was due to the forecast of frost. The saving in lettuce here was 500 baskets worth \$1.50 per basket. Amount saved, \$750.

We received the warnings about 11:30 a. m. and the cold-wave flag was hoisted at once. Those who were not celebrating New Year banked the trees, and thus saved them.

The following suggested plan for the protection of orange groves from frosts, published in a Florida paper is of interest in this connection:

Titusville, Fla., Indian River Advocate, January 28, 1898.—For a 5-acre grove. Erect a 20-foot fence on the northwest end of grove; another 20-foot fence on southeast side of grove, with a running board directly through the center, so that upon the notification of a cold wave coming from the Weather Bureau, you can run canvas from the northwest and southeast corners to the center running board and fasten it. Have side flaps for your grove which you can drop and fasten to your baseboard running all round.

Then set your resin pots burning inside, enough to make a black smudge, and, in the judgment of the writer, no freeze that you have ever had in Florida would hurt your orange trees.

This plan would also apply to pineapple plantations and vegetable gardens along the east coast or in any other section in Florida, only you would not have to build your fences so high.

To demonstrate the actual saving, if any one in Florida chooses to adopt this plan, we will say that a 5-acre orange grove costs the owner in ten years \$5,000. His income from that grove should be \$2,000 per annum, making in the ten years \$20,000. Original cost \$5,000, making a total of \$25,000. This is the amount he would lose if his grove is frozen, as it would take nearly ten years to bring it back to its original state of bearing.

In the opinion of the writer, the above covering and fences can be built and made to cover a 5-acre orange grove for at least \$2,000, thereby making a net saving to the orange grower of \$23,000.

FROSTS AND FREEZING WEATHER IN THE CITRUS REGIONS OF SOUTHERN CALIFORNIA.

In regard to these conditions Mr. W. H. Hammon, Forecast Official in charge of the San Francisco forecast district, composing California, Nevada, Utah, and Arizona, reports as follows:

Injury from frost occurred in various portions of the citrus region of southern California on the following dates, as determined from reports of regular and voluntary observers and newspaper articles, viz: January 10, 11, 12, 13, 20, 21, 23, 24, 25, 26, and 27. In no instance was there injury in all sections of the citrus region, but there are few sections in

which no injury whatever occurred on some one of these dates, and in some instances the critical temperature was reached on as many as five different dates in January. The most generally severe condition occurred on the morning of January 27. In every instance satisfactory warnings were issued by this office.

On January 10 the warning to the various places in the citrus region of southern California read: "Killing frosts to-night, possibly injurious to citrus fruit." This message was received on January 11. On January 12 it read: "Cooler to-night with killing frost, injurious to citrus fruit where clear and still." On the 13th the message read: "Killing frosts to-night, some danger to citrus fruit." On January 20 a warning was issued to this same region of, "frost to-night, possibly injurious to citrus fruit." On the 21st the warning read: "Killing frost to-night, some danger to citrus fruit." On the 23d this warning was repeated. On the 24th the warning read: "Killing frost to-night, probably injurious to citrus fruit." On the 25th the message read: "Probably frost to-night, injurious to citrus fruit where clear." The warning of the 26th read: "Killing frost to-night, generally injurious to citrus fruit."

Below is given a table of minimum temperatures at various points in southern California during December, 1895, December, 1897, and January, 1898, which have been taken from the records of the regular and voluntary observers in that region:

Stations.	December, 1895.	December, 1897.	January, 1898.	Stations.	December, 1895.	December, 1897.	January, 1898.
Anahelm.....	37	35	26	Redlands.....	33	37	27
Colton.....	29	27	26	Riverside (A. H.)..	29	37	30
Crafton.....	28	24	23	San Bernardino.....	25	37	24
Escondido.....	22	18	21	San Diego.....	34	36	36
Fallbrook.....	32	30	29	Santa Barbara.....	38	33	34
Los Angeles.....	34	30	31	Santa Paula.....	33	20	24
Ontario.....	32	28	29	Ventura.....	36	26	25
Pomona.....	28	25	26				

From these temperatures it will be observed that, on the whole, slightly lower temperatures were recorded this year than in the freezes of the other months mentioned.

The statement is generally made in newspapers that in many places lower temperatures were recorded in January, 1898, than in many years previous, and the amount of injury to citrus fruit during the January freeze is generally estimated at from 10 to 20 per cent. The value of the orange crop alone is estimated at from \$6,000,000 to \$7,000,000. A comparison of the minimum temperatures during this season (December, 1897, and January, 1898) with those of 1895, shows that in almost every instance lower temperatures occurred this season than in 1895, while the injury to the citrus crops will not exceed one-half that of 1895. The only reasonable explanation of the diminished injury will seem to be the greater efforts to protect the crop this season than heretofore, in accordance with the warnings received from this office, and suggestions previously made, relative to efficient means of protection. It would seem, from a comparison of these temperatures, that the saving resulting from these means must, to the various citrus crops, amount to several millions of dollars.

FROSTS IN TEXAS.

Frosts and freezing weather occurred in the truck-growing regions of Texas in vicinity of Galveston on January 2, 16, and 27, warnings of which were, in each instance, sent out by the Local Forecast Official at Galveston, on the preceding day, and enabled growers to effectively protect their crops.

STORMS OF 21-23 AND 24-26.

These two storms which were of marked severity developed, the first in southwestern Texas and the second in Arizona, and following nearly the same path moved northeastward across the central valleys and lower Lake Region and off the New England Coast. They were accompanied by heavy precipitation which, falling as snow in the northern portions of the regions traversed and being attended by high winds, caused considerable damage to various interests and interruption to traffic, particularly in northern Illinois, Wisconsin, and Lower Michigan.

The following maximum wind velocities, in miles per hour, were reported during the twelve hours ending with the hours named: 22d, 8 p. m., Chicago, 68; Cairo, 56. 23d, a. m., Chicago, 60; Cleveland, 52; Erie, 48; 23d, 8 p. m., Cleveland, 72; Buffalo, 76; New York and Eastport, 60. 25th, 8 p. m., St. Louis, 68; Cairo, 56; Indianapolis, 52; Chicago, 64;

Memphis, 52. 26th, 8 a. m., Chicago and Cleveland, 46; Cincinnati, 42.

The storm of the 21st-23d was notable for the unusually high tides which it caused on the Massachusetts Coast, and from which considerable damage resulted to seaport cities and towns in that region.

Prof. E. B. Garriott, in charge of the Chicago forecast district, reports as follows in regard to the warnings issued for these storms from the Weather Bureau Office in Chicago:

The first important storm appeared over the lower Mississippi Valley the morning of the 22d. Calculating that the storm center would move northeastward with increasing energy, the following warning was telegraphed all open lake ports at 9:30 a. m.: "Heavy snow and increasing and high northeast winds indicated for next twenty-four hours," and warning of heavy snow was sent to Lower Michigan, south and east Wisconsin, Iowa, eastern Missouri, northern Illinois, and northern Indiana. At 1:15 p. m. lake ports were again telegraphed as follows: "Present conditions indicate dangerous northeast gale and heavy snow during next twenty-four hours."

Three days later another storm of the same type and following almost the same path appeared. On the morning of Monday, the 24th, a "norther" was forecast for Iowa, south and east South Dakota, Nebraska, Kansas, and Colorado; cold-wave signals were ordered for western Iowa, south and east South Dakota, Nebraska, and Kansas; and lake ports were notified that "Heavy snow with increasing easterly winds was indicated by Tuesday morning." Heavy snow was forecast for southern Minnesota, and for Tuesday in Lower Michigan and Wisconsin. At 1:40 p. m. warning of heavy snow was sent to western Missouri. At 9 a. m. of the 25th, when the storm center had advanced to the middle Mississippi Valley, lake ports were wired that "Heavy snow and dangerous northeast gales, shifting to-night to north, may be expected; cold-wave warnings were extended eastward over the balance of the Chicago district, except Upper Michigan; warnings of heavy snow were repeated to Lower Michigan and south and east Wisconsin, and were carried over northern Illinois and northern Indiana.

The areas covered by heavy snow were remarkably well defined in the forecasts and warnings, and cold-wave warnings were verified over practically all the territory to which they were sent, although in localities the verifications were scarcely technical. The northeast gales which attended the storm were particularly severe. Great benefit was undoubtedly derived from the very ample and accurate warnings. No marine disasters on the Lakes resulted from the storms. The night of the 26th the steamer *City of Duluth* ran aground on a bar at the entrance to the St. Joseph, Mich., harbor, and the high sea left from the storm of the 25th and the accumulated ice contributed to the final loss of the vessel and cargo.

The time has arrived when the vast shipping and produce interests and the transportation companies recognize the great commercial value of the forecasts, and on the Lakes travelers and shippers mistrust the shipmaster who assumes to ignore the storm warnings of the Weather Bureau.

Storm signals for southeast to south gales on the New England and New Jersey coasts were ordered from the Central Office at 10:15 p. m. of January 22, and cold-wave signals throughout western Pennsylvania, western New York, and Ohio on the morning of the 23d.

At 2 p. m. of the 25th, southeast storm signals from Eastport to Baltimore and southwest storm signals from Fort Monroe to Wilmington were ordered with a warning of southeast to south gales with snow or rain. These warnings were thoroughly distributed and of undoubted value. Concerning the storm of the 21st-23d, a dispatch from Chicago of January 23, published in the Washington Times of January 24, states that:

On the lake no steamers could long have escaped unscathed, but as far as known every vessel, through the early warning of the Weather Bureau, was able to run into a safe harbor.

SEVERE SNOW AND WIND STORM OF JANUARY 31-FEBRUARY 1.

The severe snow and wind storm that passed over eastern New York and New England on January 31 and February 1, 1898, was of unusual violence and destructiveness. As the morning map of February 1 was incomplete on account of the nonreceipt of reports from some of the stations near the center of the storm, it was thought desirable that a series of charts, showing the weather conditions and the location of the storm at the time of the two regular observations of January

31 and February 1, be published in this REVIEW. (See Charts Nos. X, XI, XII, XIII.) This storm may be said to have been the outcome of two disturbances that appeared on January 29, on the eastern Rocky Mountain Slope at the northern and southern extremities, respectively, of a trough of low pressure extending from Manitoba to Texas. These disturbances with the connecting trough moved slowly eastward with but slight increase in energy, and on the morning of Monday, January 31, were central, one over Lake Huron with a barometer reading of 29.50, and the other off the North Carolina Coast. (See Chart No. X.) The conditions at this report have a close resemblance to those preceding the memorable blizzard of March 12 and 13, 1888. The probable junction of these depressions and the dangerous nature of the resultant storm were then evident, and at 9:45 a. m. on the 31st, storm southeast signals were hoisted from Hatteras to Eastport with warning of "southeast gales and heavy snow," and instructions issued to observers in the threatened regions to warn shipping and railroad interests. Cold-wave warnings were issued on the evening of the 31st for New England, eastern Pennsylvania, New York, New Jersey, Virginia, District of Columbia, and eastern North Carolina. At 8 p. m. of the 31st the storm formed from the union of these two disturbances was central on the southern New England Coast, with greatly increased energy, the barometer at Block Island reading 29.26 with a northeast wind of 52 miles. (See Chart No. XI.) The storm increased greatly in intensity during the night and moved northeastward to the Maine Coast, the center passing between Block Island and Nantucket and between Nantucket and Boston. (See Chart No. XII.) The lowest pressure at Nantucket, 28.63, occurred about 3 a. m., February 1, and at Boston, 28.78, about 3:30 a. m. of the same date. Maximum velocities of 60 miles northeast at Block Island, 71 southeast at Nantucket, 50 northeast at Boston, and 38 north at Portland, occurred during the night, and the high winds, in connection with the heavy snow that fell, caused great destruction to shipping on the New England Coast, and great damage to railroads, telegraph, and telephone lines throughout eastern New York and New England. The warnings issued on the morning of the 31st were given the widest possible distribution throughout the threatened regions, and as shown by the reports received were of great benefit.

The following extracts from reports of Weather Bureau officials, descriptive of the storm, and from newspapers in relation to the warnings are given.

From Wm. Davis, Observer, Block Island, R. I.:

The storm reached a verifying velocity at 8:20 a. m., January 31, and continued to increase gradually, reaching 60 miles per hour at 10:30 p. m., and after midnight the wind began to diminish slowly, but continued above the verifying velocity till 6 a. m., February 2. Light snow fell from 2 a. m. to 8:40 a. m., on January 31, when the snow turned to rain. Heavy rain fell during the afternoon and evening, and during the night rain turned to snow again, ending at 3:30 p. m., total amount, including melted snow, 2.25 inches.

Southeast signals were received at 10:40 a. m., January 31, and at 7 a. m., February 1, they were changed to northwest by the observer, as telegraphic communication was cut off. The warning was thoroughly and promptly distributed among the fishermen and those interested in other pursuits, the former recognizing the warnings to be of the greatest benefit, especially since November 9, when six fishing smacks dragged anchor and went ashore in Great Salt Pond, during a northwest storm, warnings of which were displayed well in advance to all parties interested.

Although the storm of January 31 and February 1 was quite severe, there were no disasters in this vicinity, and as far as can be learned, there was no damage done on the island, which is due to the fact that the people are placing confidence in the warnings.

From W. W. Neifert, Observer, Nantucket, Mass.:

The order to "Hoist southeast signals" was received here at 10:36 a. m., January 31, and the information was immediately telephoned to Great Point, and generally distributed about the town, as is usual in such cases, and the signals displayed. * * * The storm was the most severe on record here.

From John W. Smith, Local Forecast Official, Boston, Mass.:

The temperature ranged at or below freezing throughout the storm. The precipitation was wholly in the form of moist snow, the total depth of which was 14.3 inches; melted, 1.38 inch. Snow began falling at 8:15 a. m., January 31, and ended 2:40 p. m., February 1.

The storm warnings, order to hoist southeast storm signals, and warnings of heavy snow were received at 10:21 a. m., January 31. The warnings were at once bulletined, and were telephoned to all transportation companies, to newspapers, and furnished to the press and news associations. The dissemination was most thorough and the warnings timely. Much interest was manifested, especially by the transportation companies. The railroad and street car companies acted promptly in distributing wrecking forces, snow plows, etc. No vessels left the harbor during the storm.

The storm was tremendously destructive in this vicinity to property and to life. Not since March 12, 1888, some say January 17, 1867, has such a blizzard reached New England. The heavy snow blockaded the street cars and greatly delayed steam railroad travel, and in a few instances trains were temporarily blockaded. There was a general wrecking of overhead wires, and hundreds of poles, iron and wood, were blown down or fell from greatly increased strain from the clinging snow and falling wires. Although the danger from crossed and live wires was very great, no person was killed, although about 30 horses were electrocuted in various parts of the city. Only for the mild weather that prevailed during the storm considerable loss of human life must have resulted among the many who were caught out in the storm. The storm also served to close up the school system, close many of the large stores, and threaten a milk famine. On the New England Coast it brought death to more than a score of mariners, destruction to 10 vessels, and damage to as many more. The bodies of 7 sailors were recovered at Nahant, Mass., 4 at Gloucester, Mass., 3 at Rockport, Mass., and 12 at Bakers Island, Mass.

Conservative and reliable estimates place the loss by the storm to electric and steam railroads, telegraph and telephone companies in the city of Boston and neighboring cities and towns, to corporations and individuals generally at about \$1,500,000. The damage to shipping is estimated at from \$150,000 to \$200,000.

New York Commercial American, February 3, 1898.—Notwithstanding the Weather Bureau gave prompt warning of the approach of a storm, thus enabling masters of vessels in port to avoid danger, incoming vessels had no such warnings, and many of them met with more or less serious disaster.

Albany Journal, February 1, 1898.—Had it not been for the timely warnings sent out by the Chief of the Weather Bureau at Washington yesterday to the railroads of this section, things would be in a much worse state. As it is, things are bad enough, but the storm found the roads ready with the great plows and gangs of men.

Times-Union, Albany, N. Y., February 1, 1898.—The heavy snow warning sent out by the Weather Bureau was of the greatest value to steam and surface railroads, also the shipping merchants in this section of the State. All interests received timely warning and made extensive preparations to keep the lines of travel open.

The following newspaper extract relating to the general subject of maritime warnings issued by the Weather Bureau is given as of interest in this connection:

New York Journal, January 9, 1898.—While it was said that the Weather Bureau predictions are not always absolutely relied upon, and that in the matter of forecasts the service is still not an exact science, it was shown that thousands of vessels and millions of dollars worth of valuable property are saved annually through the timely warnings of this Bureau, and to say nothing of the preservation of human life.

The mail steamers do not, of course, let any adverse forecasts prevent their sailing. Their owners can not afford to. These vessels are scheduled to leave port at a certain hour, and when that hour arrives the mail contracts, express business, and, indeed, the passengers themselves demand that the steamer shall proceed at the time agreed upon.

Despite hurricane signals the transatlantic liners steam to sea, but their captains bear the signals in mind just the same. They know when a hurricane is likely to sweep over their vessels, and they prepare for it.

Superintendent Houghton, of the Maritime Exchange, said:

The forecasts have not reached an absolutely scientific basis yet, but forecasts of the Weather Bureau are valuable, and many vessels are undoubtedly saved from wreckage by heeding them. Some idea of the vast floating interests on the Atlantic Coast may be had when I tell you that 5,628 transatlantic steamers, with an aggregate tonnage of 10,076,148, and 5,842 sail craft, aggregating 2,105,688 tons, enter and leave ports on the Atlantic seaboard during a single year. The value of the cargoes is now more than a billion and a half dollars.

Our coastwise traffic is tremendous. In one year more than 17,000 sailing vessels and 4,000 steamers enter and leave the ports between

Maine and Florida. Their cargoes are estimated at \$7,000,000 in round numbers; so you see the value of the property the Weather Bureau aims to protect by warnings of approaching storms.

The pilots generally praised the weather forecasts as their greatest aids. "We watch them every time," said one, "and you may depend that a large number of the navigators do also. I remember well of taking out a Ward liner, and just before we left the dock the captain saw hurricane signals on the Weather Bureau. As a result the steamer anchored in Gravesend Bay, and there was a small fleet anchored near us for just the same reason. The forecasts are invaluable to navigators."

FLOOD IN THE OHIO AND CENTRAL MISSISSIPPI VALLEYS.

Between January 8 and 26 six storms developed in the southwestern portion of the United States, or in northern Mexico, and following closely the same path, moved north-eastwardly across the central Mississippi and Ohio valleys. These storms were attended by excessive precipitation in the valleys named, the total amount for the month being from 6 to 10 inches, or from 2 to 5 inches in excess of the normal, which resulted in a moderate flood during the latter part of January and forepart of February in the Ohio and in the Mississippi below Cairo. The river was above the danger line at Cincinnati from January 20 to 29, inclusive; at Louisville from January 21 to 30, inclusive; at Cairo from January 24 to February 6, inclusive; at Memphis from January 30 to February 8, inclusive; and at Vicksburg from February 4 to 17, inclusive.

Warnings of this high water were issued by the Weather Bureau officials in charge of the river forecast districts in their region well in advance of its occurrence, and were of considerable benefit, as shown by the following extracts from reports from officials in charge of river centers, viz:

From letters received from P. H. Smyth, Observer, Cairo, Ill.:

MOUNT VERNON, IND., February 15, 1898.

The information furnished by the Weather Bureau was the means of a great many farmers saving stock and all farming implements by removing them to high ground.

SHAWNEETOWN, ILL., February 11, 1898.

The loss in our bottoms was almost confined to the loss of corn, which is something over 10,000 bushels. A few hogs were lost, but no cattle or horses.

The reports are of great value to our people, and they were especially so, as the flood was unexpected in January. The reports gave our farmers warning in time to get their stock removed, and to obtain facilities for getting rid of their corn. Our people depend upon these reports and act on the information they give them. We notified Blackburn, Ky., and Saline Mines, Ill.

At the time the warning was received there were in the bottoms, between the mouth of Wabash and Saline rivers in Illinois and Kentucky, cattle, horses, and hogs, valued at between \$55,000 and \$60,000.

From S. C. Emery, Local Forecast Official, Memphis, Tenn.:

The most marked benefit resulting from the flood warnings were in connection with levee work along the St. Francis and Yazoo basins. By being advised that a 40 or 42 foot stage would be reached at Cairo, and that it would reach at least 33 feet at Memphis, the engineers in charge of this work were enabled to so far repair the crevasses made last year, or build such temporary protection as would sustain the expected flood wave. At Craighead Point and other points in the St. Francis levee system a large force was set to work, while to the south at Flower Lake and Stopps Landing, about 400 teams and as many men were constantly employed, so that by the end of January the levees in this section were in very good condition. This prompt and energetic work on the levees, together with the assurance given out from this station that no disastrous overflow was probable, did much to preserve a feeling of security among the people and prevented much unnecessary moving of property. The reports and warnings were freely distributed through the country by means of the press, river bulletins, and maps, so that most of the inhabitants were fully informed as to the situation, as well as what might be expected.

AREAS OF HIGH AND LOW PRESSURE.

By Prof. H. A. HAZEN.

During the month the apparent paths of ten highs and twelve lows were sufficiently defined to be traced on Charts

I and II. The accompanying table exhibits a few facts regarding the apparent place of origin and disappearance of these highs and lows, their duration, length of path, and velocity. The most remarkable feature of these paths during the month is the fact that both high and low areas all passed to the ocean off Newfoundland. Another peculiarity is their very great apparent velocity, reaching 36.6 miles an hour in the case of the lows.

HIGHS.

These conditions in general took their origin to the north of Montana, though the permanent high area in the middle Plateau Region gave rise to several. Owing to the continuance of the rather permanent high pressure in the middle Plateau Region the temperature conditions were rather moderate in the Mississippi Valley and eastward to the Atlantic Coast. As high No. V moved toward the Mississippi Valley it caused a fall in temperature of 32° in twenty-four hours and to 36° at Memphis, 13th, a. m. The next morning there was a fall of 32° in twenty-four hours at Cleveland.

LOWS.

The lows of the month have had a peculiar distribution in that six of them have begun off the south Pacific Coast or in the extreme Southwest; five of them to the north of Montana, and one off the north Pacific Coast. They have all moved to the Gulf of St. Lawrence. As No. VI moved to the north of Arkansas on the night of the 11th a severe tornado occurred at Fort Smith in the southeast quadrant.

The highest wind of the month was 68 miles an hour at Chicago, afternoon of 22d, and while low area No. IX approached the Lake Region.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.							<i>Miles.</i>	<i>Days.</i>	<i>Miles.</i>	<i>Miles.</i>
I.....	3, a. m.	50	87	5, a. m.	46	62	1,370	2.0	685	28.5
II.....	3, a. m.	42	111	6, p. m.	45	50	2,860	3.5	817	34.0
III.....	4, p. m.	43	114	9, a. m.	28	80	2,690	4.5	598	24.9
IV.....	8, p. m.	53	119	12, a. m.	47	59	2,680	3.5	766	31.9
V.....	12, p. m.	45	114	13, p. m.	46	58	3,040	3.0	1,013	42.2
VI.....	12, p. m.	54	116	20, p. m.	47	60	4,400	8.0	550	22.9
VII.....	20, p. m.	34	89	23, a. m.	47	57	1,920	2.5	768	32.0
VIII.....	21, p. m.	40	113	25, p. m.	47	67	3,150	4.0	781	32.8
IX.....	25, a. m.	50	119	28, p. m.	47	74	2,100	3.5	600	25.0
X.....	28, a. m.	54	109	31, p. m.	47	56	2,800	3.5	800	33.3
Total.....							27,010	38.0	7,384
Mean of 10 tracks.....							2,701	738	30.8
Mean of 38 days.....									711	29.6
Low areas.										
I.....	1, p. m.	54	111	4, a. m.	48	54	2,680	2.5	1,072	44.7
II.....	2, a. m.	51	111	6, a. m.	47	54	2,950	4.0	843	35.1
III.....	4, p. m.	53	116	7, p. m.	46	58	2,840	3.0	947	39.5
IV.....	5, p. m.	51	115	9, a. m.	47	59	2,580	3.0	860	35.8
V.....	7, p. m.	37	100	10, p. m.	48	51	2,750	3.0	917	38.2
VI.....	10, p. m.	32	105	13, p. m.	48	55	2,980	3.0	993	41.4
VII.....	12, a. m.	34	120	16, p. m.	46	56	4,030	4.5	895	37.3
VIII.....	15, p. m.	31	103	21, p. m.	45	56	3,160	4.0	790	32.9
IX.....	19, p. m.	32	115	24, p. m.	49	56	3,690	5.0	738	30.3
X.....	23, a. m.	21	114	27, a. m.	47	55	3,570	4.0	892	37.2
XI.....	26, a. m.	53	115	29, p. m.	43	58	2,920	3.5	834	34.6
XII.....	28, p. m.	48	128	2, a. m.*	48	64	3,390	4.5	753	31.4
Total.....							37,540	44.0	10,534
Mean of 12 tracks.....							3,128	878	36.6
Mean of 44.0 days.....									853	35.5

* February.

THE WEATHER OF THE MONTH.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

The statistical aspect of the weather of the month is presented in the tables which form the closing part of this REVIEW. The numerical values of the tables have been generalized in a number of cases, the results appearing on Charts Nos. III to IX, inclusive. Table I in particular contains a variety of details from which the reader may select those most interesting to himself.

PRESSURE AND WIND.

In the United States in January the map of normal isobars shows that a ridge of high pressure extends diagonally across the country from Georgia to Washington. There are two areas in this ridge of high pressure with values over 30.20 inches, viz, one in the west covering Utah, Nevada, and portions of the adjoining States of Oregon, Idaho, Wyoming, and Colorado, and one in the east overlying the mountainous regions of Tennessee, northern Georgia, and parts of the Carolinas. Pressure is lowest over the north Pacific Coast and the Canadian Maritime Provinces, whence it decreases to the permanent areas of low pressure occupying the North Atlantic and Bering Sea, respectively.

The normal prevailing winds on the Atlantic and Gulf coasts are from the northwest and north, from the colder land to the warmer water surface. On the Pacific Coast the winds generally coincide with the direction of the coast line; on the upper half of the coast, say from Eureka northward, southerly winds are most likely to prevail; on the southern half northerly winds are most frequent. The winds of the Plateau and Rocky Mountain regions are somewhat variable, southwesterly winds generally prevailing west of the mountains and northwesterly on the easterly slope and the plains

beyond. The winds of the middle and upper Mississippi Valley are westerly or northwesterly; westerly winds also prevail in the upper Lake Region, while the winds of the lower Lake Region and Ohio Valley are generally southwesterly.

In January, 1898, pressure was higher than usual on the north and middle Pacific Coasts, over the Plateau Region, and the lower portion of the Florida Peninsula. Elsewhere it was lower than the average. The notable feature of the month was the very high pressure over the Plateau Region. The position and magnitude of the area of high pressure in this region determine, in a great measure, the character of the weather on the Pacific Coast, and also in a somewhat less degree east of the Rocky Mountains.

It will be noticed by an inspection of Chart IV that the western area of high pressure extends farther to the westward and northward than usual, thus giving cold northerly and northeasterly winds to California and Arizona. On the northern and northeastern sides of the high the winds were southwesterly or southerly, and the weather of Montana and the Dakotas was relatively warm and pleasant. The pressure distribution of the present month is very similar to that of January, 1891, as may easily be seen by a comparison of Chart II of the REVIEW for that month with Chart IV of the current REVIEW. There is also a marked similarity between the conditions of temperature and rainfall of the two months.

TEMPERATURE OF THE AIR.

The normal temperature of the air in the United States in January varies from about 70° at Key West, 56° at Jacksonville, 54° at New Orleans, Galveston, and San Diego to